Strategic Plan for Water Supply Management in the Wider Area of Thessaloniki

Alexandros Mentes

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Student Name:	Alexandros Mentes
SID:	1101150012
Supervisor:	Prof. Marco Sampietro

I hereby declare that the work submitted is mine and that where I have made use of another's work, I have attributed the source(s) according to the Regulations set in the Student's Handbook.

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Abstract

This dissertation was written as part of the Executive MBA (EMBA) at the International Hellenic University.

Municipal Water and Sewage Authorities (MWSA) lack of knowledge and implementation of an organized Project Management structure in their projects realization is an existing problem that Greek water industry is experiencing in our days.

The scope of this dissertation is to deliver a practical Project Management Plan (PMP) to MWSA that will make the project planning reality, will maximize the chances of success, will give all the tools in the real environment to exploit the already existing know-how the companies possess, enable stakeholders involvement and will help to increase companies annual turnover.

To achieve this, an extensive PMP is created for Thessaloniki's Water Supply and Sewerage Authority (EYATH S.A.-company) in order to help the company implement a 68mil.€ operational plan for distributing potable water in the wider area of Thessaloniki. Due to its structural integrity, this "pilot" PMP or its autonomous building blocks can be applied in the Greek water industry by the MWSA.

At this point I would like to acknowledge and give special thanks to my supervisor, Professor Marco Sampietro, for his invaluable guidance, help, support and supervision from the beginning until the completion of this dissertation. I am sincerely grateful for the chance he offered me to work with him and advance my research skills in his area of expertise and more specific in Project Management. I also would like to offer special thanks to EYATH SA for providing me with the economic means to participate in the Hellenic University EMBA 2015 programme and all employees that provided the necessary information. Last but now least my family for supporting me and standing by my side.

Keywords: project management, Stakeholder analysis, project organizational structure, construction and rehabilitation of water works, water operational Plan.

Mentes Alexandros

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1 Introduction

The purpose of this Business Consultancy Project (BCP) is to create a Project Management Plan (PMP) that will help Thessaloniki Water Supply and Sewerage Authority (EYATH S.A.-company) walk through the process of constructing new and rehabilitating existing water works, in order to transfer and distribute all the available potable water produced after completion of its new water refinery that will ensure an additional 150.000,00m^3 per day of potable water to the wider area of Thessaloniki. Furthermore, this PMP will ensure energy savings and reduction of Non-Revenue Water in the existing water distribution systems. This new water refinery will give EYATH SA the "inventory" (new volumes of water) to enter into new water supply geographical areas (new markets). All the above necessary water construction and rehabilitation works can be found in the Operational Plan for Distributing Potable Water in the wider area of Thessaloniki. This plan was approved by the BoD in 2016.

The expected outcome of this BCP is to provide a detailed statement of a strategic plan for water supply management in the wider area of Thessaloniki and to help the CEO and the Board of Directors to understand and to allocate all the human and financial resources (time and volume) in order to implement the project. Furthermore, it will help all the key and new personnel of the company to understand all the processes involved in the project and it will improve the company's ability to plan all the necessary water construction works in order to ensure the delivery of the additional volume of water produced (150.000,00m^3) by a new refinery.

The PMP is expected to ensure that, together with the new water construction works, rehabilitation and modernization of existing water consumption works will take place. These operations will minimize energy consumption in the water supply system and decrease physical water losses.

Overall the expected outcomes of this Business Consultancy Project are to deliver a practical PMP to EYATH SA that will make the project planning reality, will maximize the chances of success, will give all the tools in the real environment to exploit the already existing know-how the company possess and will help to increase company's consumers and its annual turnover.

1.1 Presentation of the company

Thessaloniki Water and Sewage Authority (EYATH SA) operates in the broader area of Thessaloniki and is responsible for delivering fresh-potable water to approximately 1.2mil. people in a wider service area of approximately 100sq Km and for collecting, transferring and treating-cleaning wastewater before disposing it back to the environment. The volume of daily water demand (water needs-consumption) is a primary concern of the company, because on the one hand this demand must be met by the available water resources and on the other hand water must be transferred to the consumers premises, which requires big construction water supply works. Today's average daily water demand in the city of Thessaloniki is 250.000,00m^3.

The company employs 224 employees and another 100 through its subsidiary EYATH SERVICES SA. Annual turnover has been reduced from 2009 to 2013 by 6.56%, from 77,376mil. € to 72,299mil. €, which was the lowest as of the company's creation. In 2014 the turnover was 73,69mil.€ and in 2015 dropped again to 73,05mil.€.

The company's EBIT and earnings after tax consistently remained almost the same for the last three years (2013 - 2015) at the level of 20,5mil.€ and 13,5mil.€ respectively. Company's profitability also remained approximately the same for the same years. The figures for Return On Assets (ROA) and Return On Investment (ROI) indicators are shown in Table 1.

Table 1: EYATH S.A. ROA and ROI indicators progress.

	2015	**2014**	**2013**
Return On Assets (ROA)	10,64%	10,64%	9,26%
Return On Investment (ROI)	13,80%	13,83%	12,38%

According to the company's 2015 annual report, its cash and cash equivalents reach 50,1mil.€, a very big figure if we consider its usual annual turnover of 73,05mil.€ in 2015.

2 Legal framework & Market analysis

2.1 Legal framework of EYATH S.A.

EYATH SA was founded in 1998 from the merger of Thessaloniki Water Supply Organisation S.A. (OYTH SA) and Thessaloniki Sewerage Organisation S.A. (OATH S.A.). The company has the exclusive right to provide water and sewerage services in the Greater Thessaloniki Area through a 30-year exclusive concession agreement with the Hellenic Republic, effective from 2001. EYATH S.A.is listed on the Athens Stock Exchange under the tag EYAPS AT.

2.2 The market monopoly of water

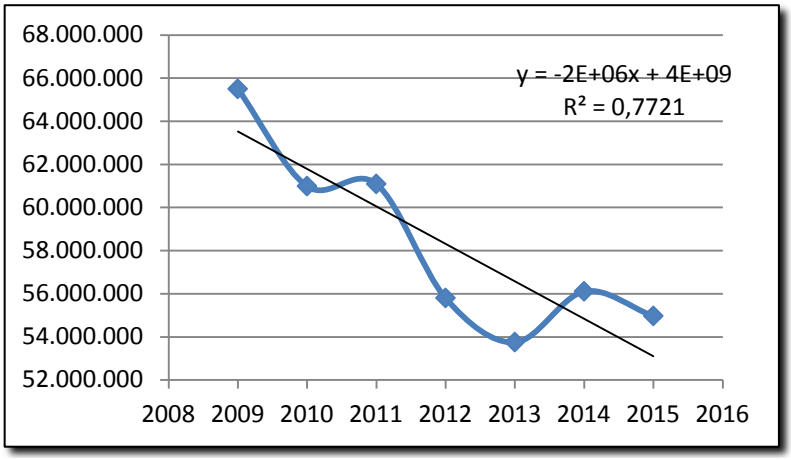
Water is a necessity for human kind. People must consume water in order to survive. The economic approach treats per capita water use as a behavioral phenomenon, reflected in a consumer-demand function for water that can be estimated from data on actual consumption. As with every commodity, demand for water depends on the price of water and the consumer's income. High income consumers can justify large water consumption, while rises in water price reduce consumption. However, this reduction falls asymptotically to zero, because some minimum level of water use is a necessity for most households [Bauman et al. 1997]. Consequently, EYATH SA company, which holds a monopoly in the business, is not facing the possibility of zero sales. Taking in account that, as we will see in the following section, water consumption in the city of Thessaloniki has reached its minimum quantities the last seven 7 years as demand dropped from 65,5mil.m^3 in year 2009 to 54,97mil.m^3 in 2015.

2.3 The demand for water

With the ongoing Greek crisis and the uncertainty of its final outcome EYATH S.A must be fortified against a further reduction in water demand. From Figure 1 we can see that, for the last 5 years, water consumption is reduced on the average by 2,0mil.m^3 per year. The yearly water consumption declined by 17,94% from 2009 until 2013,

despite the fact that water tariffs were kept unchanged for the last 4 years, while Greek CPI was dropping.

Figure 1: Five years water consumption (in cubic meters-m^3).



Year	2009	2010	2011	2012	2013	2014	2015
Consumption (in mil.m^3)	65.50	60.99	61.09	55.80	53.75	56.11	54.97

A Cost Volume Profit analysis made for EYATH S.A. in 2015 [A. Mentes, 2015] illustrated that although consumption cannot drop to zero (water is a necessity), a further reduction of water demand down to 42,267 million cubic meters (reduction of 2013 consumption by 21,37%) will eliminate EYATH SA profits. This analysis also demonstrated that sales cannot be increased by reducing the price of water due to the low price elasticity of water demand. Taking into consideration that sales cannot be increased, decisions must be taken and efforts must be made mainly to reduce fixed cost and increase margin of safety. This way the company can reduce its vulnerability of revenues[1] (a 10% decrease of fixed costs will decrease vulnerability of revenues from 78,63% to 70,77%). Considering the above fact, a good starting point is on the one hand to take actions for the reduction of nonrevenue water (unaccounted for water sold - real and apparent water losses) and on the other hand to expand and enhance existing water works in order to deliver the above saved volumes of water to new areas and new customers. In this direction the company's BoD approved in 2016 the Operational Plan for Distributing Potable Water in the wider area of Thessaloniki.

[1] In order to find the vulnerability of revenues, the margin of safety was calculated. At current level of sales and with the company's current prices and cost structure the margin of safety is 15.453.793€ meaning that a reduction in sales of 15.453.793€ or 21,37% would result in just breaking even. This means that we have 78,63% vulnerability of revenues (100-21,37%=78.63%).

2.4 Thessaloniki water infrastructure

All the water assets and installations that E.Y.A.TH. S.A. owns or manages, on the basis of its Contract with the Greek State since 27.7.2001, are (a) the water intake works, (b) the external aqueducts (surface and underground) with the boreholes and the relevant ducts, (c) the pumping stations and reservoirs and (d) the distribution network with the ducts and hydrometers. These water works today include:

- water abstraction works,
- external water reservoirs and boreholes,
- Big external Waterlines that convey water towards the city,
- forty-one (40) Pumping stations, forty (40) tanks, 2.000Km of pipes and 510.000 water meters.

Raw water comes from three big aqueducts, spring water from the Paiko mountain water bearing stratum together, groundwater from boreholes and surface water from the Aliakmonas River. Paiko aqueduct together with the boreholes deliver clean potable water to the city, while the water coming from Aliakmonas river passes through a refinery in order to become potable.

All aqueducts deliver water from the western area of Thessaloniki Perfecture through big external waterways towards the city. On the average 100.000m^3 of water per day comes from Paiko springs, conveyed through a big external water pipeline 52Km long with a diameter of 1,65 meters. 150.,000m^3 of surface water comes from Aliakmonas river, conveyed to the refinery by an open channel, 50Km long. Inside the city water is distributed through tanks, pumping stations and pipes to consumers premises.

2.5 New areas-markets that can be serviced by the company.

The expansion of E.Y.A.TH.'s services in the water supply sector, in order to facilitate new customers, takes place in the framework of a wider expansion policy of the company. Two new residential complexes are expected to be included in the year 2018 (Nikopoli and Anthokipi area), adding approximately 4000 new water meters to the system. Apart from the above, in order to consider expanding the company's water services in new areas, new volumes of water must first be found - produced and new

water works must be build to convey - transmit this water to the customer's premises. In the next seven (7) years the company will invest 31,750mil.€ in order to construct new water works to transfer and distribute all the available potable water produced after completion of its new water refinery that will ensure an additional 150.000,00m^3 per day. After the completion of the above water works (2023) the company can add 126.000 new consumers (population) to its portfolio. This figure is expected to grow up to 305.000 new consumers in the year 2055.

3 The Project Management Plan

3.1 Stakeholder Analysis

Stakeholder analysis will help the project manager to assess a project environment and identify the appropriate forms of stakeholder involvement. More specifically, by doing a stakeholder analysis the project manager can:

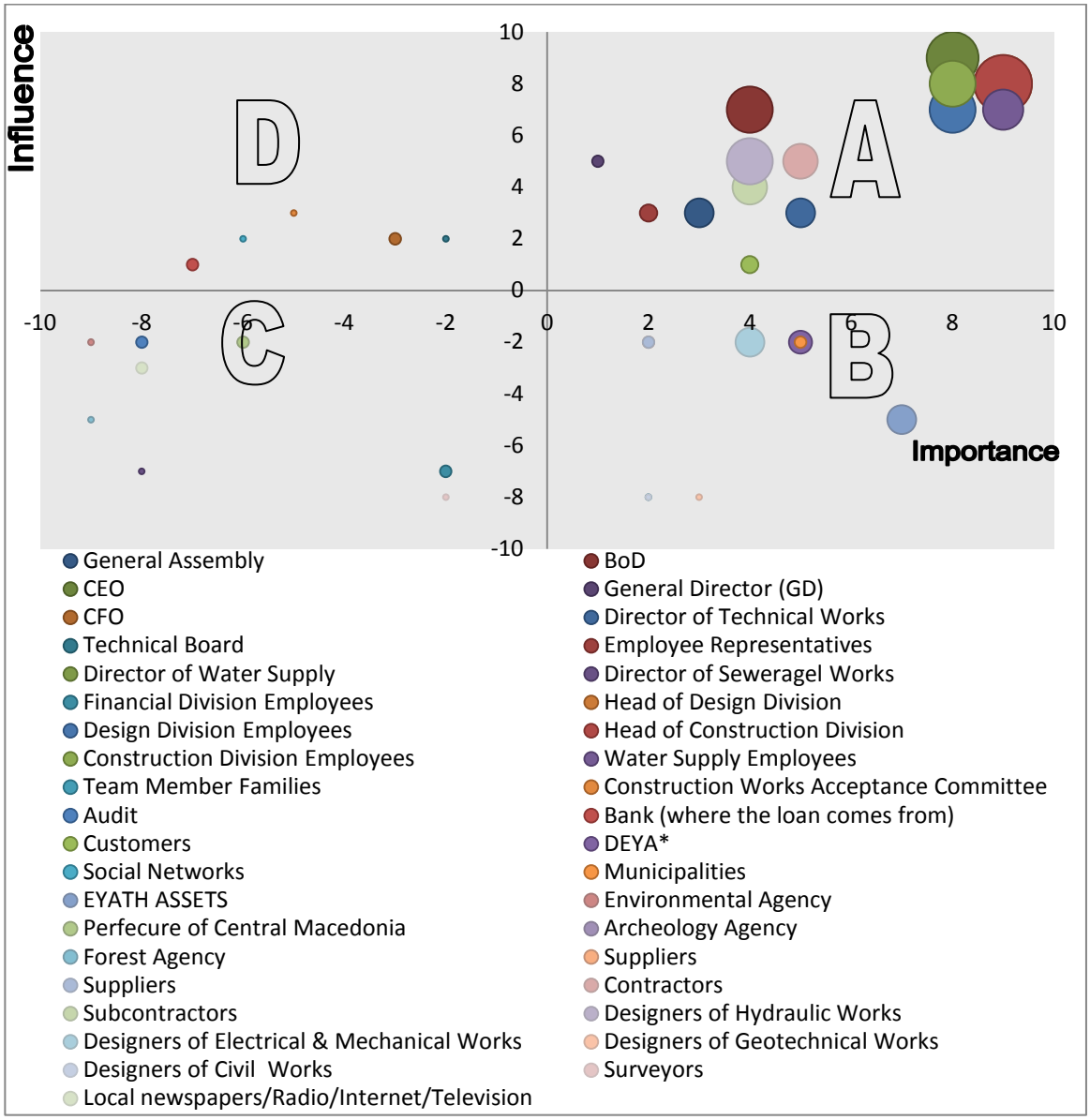
- relate the interests of stakeholders to the purpose of the project,
- identify differences in terms of interests among stakeholders, which will influence the project,
- identify the way stakeholders must be assessed in order to participate at successive phases of the projects life.

In the case of the strategic plan for water supply management in the wider area of Thessaloniki, a Stakeholder Involvement (SI) analysis is essential due to the fact that its objectives are wide and its goals can be achieved together with the cooperation of people and organizations that are not involved in the project. The first step for a SI analysis is to identify all project stakeholders. A stakeholder table of the project can be found in Appendix I. Apart from the stakeholders name the table also shows the interest (importance) - power (influence) - Attitude measures in an annotative way with a range of numbers (from -10 to 10 and from 0 to 10 for the attitude measure). Figure 2 shows the Importance - Influence classification together with the Attitude measurement (size of the bubble). Taking into consideration the quadrants of Figure 2, we can summarize all stakeholders in the following main categories:

1. High influence - High importance Stakeholders (top right quadrant-area A). These are the most important stakeholders and must be considered as key players that should be represented appropriately, because, otherwise, they can sabotage the project. If these stakeholder present a positive attitude (big bubble), they can be considered as saviors.
2. Low influence - High importance Stakeholders (bottom right quadrant-area B). The interests of these stakeholder should be represented in the project, because they can turn out to be irritant when crucial decisions must be made. If these stakeholder present a positive attitude (big bubble), they can be considered as friends.

3. Low influence - Low importance Stakeholders (bottom left quadrant-area C). These are not key stakeholders and be ignored in the project design and implementation phases. If these stakeholder present a positive attitude (big bubble), they can be considered as good acquaintance.
4. High influence - Low importance Stakeholders (top left quadrant-area D). These stakeholders appear to have the potential of becoming a high risk to the project. Consequently, a nurture relationship should be build in order to "keep them on board". If these stakeholder present a positive attitude (big bubble), they can be considered as sleeping Giants.

Figure 2: Importance - Influence - Attitude classification



In Appendix II there is an analysis of some of the important stakeholders found in area A of the importance - influence classification figure. In order to enhance stakeholders contribution to the project, the stage which they contribute and decide how the key stakeholders (the ones with high importance, high influence or both) are to be approximated, a "stakeholders summary participation matrix" was used. The basic considerations that were taken into account are:

1. potential partners in planning and implementation are the stakeholders with high influence and importance to project success and
2. stakeholders with high influence, but with low importance to project success may be "managed" by being consulted or informed.

This summary matrix is shown in the following Table 2.

Table 2: Stakeholders summary participation matrix

Type of participation	Inform	Consult	Partnership	Control
Stage in cycle				
Initiation (Identification)	General Assembly	CEO	Head of Design Division	
	BoD	Customers	CEO	
	CEO	DEYA	Designers	
	CFO			
	Social Networks			
	Municipalities			
	Local newspapers/Radio/Internet/Television			
Planning	BoD	CFO	GD	GD
	CFO	Director of Water Supply	Head of Design Division	Water Supply Employees
	Employee Representatives	Design Division Employees	EYATH ASSETS	
	Director of Tech Works	Bank	Designers	
	Customers			
	DEYA			
	Social Networks			
	Municipalities			
	Local newspapers/Radio/Internet/Television			
Execution (Implementation)	BoD	CEO	Employee Representatives	GD
	CEO	GD	CEO	Technical Board
	GD	Construction Division Employees	GD	Director of Seweragel Works
	CFO	Water Supply Employees	Director of Tech Works	Design Division Employees
	Bank		Director of Water Supply	Customers
	DEYA		Head of Design Division	Municipalities
	Social Networks		Head of Construction Division	Contractors
	Local newspapers/Radio/Internet/Television		Construction Division Employees	
			EYATH ASSETS	
			Designers	
Controlling (Monitoring & Evaluation)	BoD	GD	CEO	Employee Representatives
	Construction Works Acceptance Committee	CFO	Director of Tech Works	Director of Water Supply
	Bank	Director of Tech Works	Head of Design Division	Contractors
	Customers		EYATH ASSETS	
	Social Networks			
	Local newspapers/Radio/Internet/Television			

3.2 Project Scope

Thessaloniki Water and Sewage Authority (EYATH SA) operates in the broader area of Thessaloniki and is responsible for delivering fresh-potable water to approximately 1,2mil. people and for collecting, transferring and treating-cleaning wastewater before disposing it back to the environment. Today's average daily water demand in the city of Thessaloniki is 250.000,00m^3. The volume of daily water demand (water needs-consumption) is a primary concern of the company, because on the one hand this demand must be met by the available water resources and on the other hand water must be transferred to the consumers premises, which requires constructing big water supply works. Most of the existing water supply works have lost their ability to convey water at least by 30%, because of the hard water characteristics they carry.

Due to the

1. quick increase of people coming to live in the city of Thessaloniki during the second half of the previous century,
2. the change in the water distribution system of the center of the city,
3. the expansion of the water distribution system in order to serve more people without any comprehensive study and design,
4. lack of constructing the necessary new water supply and distribution works, some of which were studied the past decades, but now are out of date.
5. the extension of the responsibility area of EYATH SA to new districts without having developed a single plan of the required studies and projects,

the existing water supply network has serious problems of complexity, failure and high energy requirement costs.

All the above facts together with:

- the urgent need of expanding Thessaloniki's Water Treatment Facility (TWTF-refinery), in order to secure the required amount of water needed to serve new areas, already experiencing water quality problems,
- the construction in the near future (five-5 years time) of a big water refinery that will ensure additional 150.000,00m^3/per day of potable water to the wider area of Thessaloniki and

- the need of ensuring uninterrupted water supply to existing areas, reducing the water shortage risk due to failure of the existing water supply system,

suggest a prerequisite development and an implementation of a water management strategy in order to bring the additional potable water to new areas of interest and rehabilitate and modernize the existing water distribution works. The implementation of this water management strategy will reassure that the company can support its operations and services to the community at least until the year 2055.

3.2.1 Goal

The goals of this project are described below:

1. The implementation of the project will minimize energy consumption in the water supply system.
2. The implementation of the project will manage and decrease physical water losses from the water supply system.
3. The implementation of the project will increase water conservation.
4. It will minimize operational and maintenance costs of the company.
5. It will bring new customers to the company.
6. It will improve the company's ability to plan all the necessary water construction works in order to ensure the delivery of the additional volume of water produced (150.000,00m^3) by a new refinery.
7. It will ensure that, together with the new water construction works, rehabilitation and modernization of existing water consumption works will take place.
8. It will increase the company's annual turnover, through the increase of the amount of water that will be invoiced to new customers.
9. The implementation of the project will reassure access to clean water to areas in the wider Thessaloniki prefecture that face water quality problems in their systems.
10. It will provide a detailed statement of a strategic plan for water management in the wider area of Thessaloniki for approval from the Board of Directors of EYATH SA.
11. It will help the CEO, CFO and the Board of Directors to understand and to allocate all the human and financial resources (time and volume) in order to implement the project.

12. It will help all the key and new personnel of the company to understand all the processes involved in the project.

3.2.2 Milestones

As we can see from Table 3, project milestones can be categorized in three fractions. The first one has to do with the Kalamaria area water works, the second with the construction of the new refinery and the third with the rehabilitation and modernization of the existing water distribution works in the Metropolitan area of Thessaloniki. More specifically:

- The Completion of Kalamaria area designs is critical for the duration of the project, because it will give the opportunity to the company to start designing the Panorama area water works, which are dependent of Kalamaria designs. Furthermore, when the construction of Kalamaria water works is finished, the company can start constructing water supply works in order to transfer water to the new eastern area of Thermi. It can be seen from the Gantt Chart that an increase in the duration of the Kalamaria project will have a critical impact, increasing the duration, on the Panorama and Thermi water works as well.
- The same happens with the design of the three water zones inside the Metropolitan area of Thessaloniki, were it must start from the low zone and continue upwards, identifying the need for completion of the low zone design before start designing the middle one and so on. We must bare in mind that these areas will be redesigned in order to rehabilitate and modernize the existing water distribution works.
- Finally the completion of the new refinery will give all the extra volume of water needed and will mark a date were all the prerequisite water works for transferring these new quantities must be completed.

Table 3: Project Milestones.

Project Milestones	Target Date
Completion of Kalamaria area design	30-04-1018
Design completion of the Low water zone of the Metropolitan area of Thessaloniki.	20-08-2018
Completion of Kalamaria water works.	20-01-2020
Design completion of the Middle water zone of the Metropolitan area of Thessaloniki.	11-05-2020
Completion of the new refinery.	30-12-2022

3.2.3 Project Success Indicators

Table 4 shows the desired level of performance in measurable appearance, the project should reach after completion (success indicators).

Table 4: Project Success Indicators.

a/a	Project Goal	Success Indicator
1	Minimize energy consumption in the water supply system.	Reduce electricity costs by 0,9 mil euro per year (today it is 6mil only for the water system).
2	Manage and decrease physical water losses from the water supply system.	15% decrease in water losses.
3	Increase water conservation	Extend the capacity of the new waterworks by 10 years through 2065.
4	Minimize operational and maintenance (O&M) costs of the company.	10% reduction in O&M costs.
5	Bring new customers to the company.	Bring additional 126.000 new consumers (people) when project finishes and additional 305.000 throughout the life of the new construction works (until 2055).
6	Improve the company's ability to plan all the necessary water construction works in order to ensure the delivery of the additional volume of water produced (150.000,00m^3) by a new refinery.	Planning and designing of water works will start immediately after approval and follow project timetable without delays.
7	Ensure that, together with the new water construction works, rehabilitation and modernization of existing water consumption works will take place.	Approval by the BoD / Implementation according to schedule.
8	Increase the company's annual turnover	Expected annual turnover increase by 5 million euro when project finishes.
9	Give access to clean water to areas in the wider Thessaloniki prefecture that face water quality problems in their systems	Access to clean water to 65.000 people when project finishes.
10	Provide a detailed statement of a strategic plan for water management in the wider area of Thessaloniki for approval from the Board of Directors of EYATH SA.	Approval by the BoD.
11	Help the CEO, CFO and the Board of Directors to understand and to allocate all the human and financial resources (time and volume) in order to implement the project.	New employees will be hired to work in the project / Adequate financial support will be granted throughout the project life.
12	Help all the key and new personnel of the company to understand all the processes	Activity durations are met / Delays doesn't come from personnel

	involved in the project.	misinterpretation-procedure confusion.

3.2.4 Boundaries and Constrains

This project does not include the construction of the new refinery, which will be constructed by the Greek Government. The construction is only included as one overall task mainly for understanding the whole duration of the project. Moreover, the project does not include the rehabilitation of existing or the creation of new hydraulic systems inside the new expansion areas of interest, but only the provision of bulk quantities to a certain hydraulic component (tank, valve etc). The above rehabilitation or expansion is a responsibility of the respective municipalities.

In order to communicate the project inside the company, it must be presented to different kind of employees, depending on their status and position in the company. This requires the preparation of presentations with different approaches depending on the audience, a task that is not included in this project.

This project should be adapted and modified according to progress, due to the long duration of the project (increases uncertainty) and the complexity of the related tasks (construction of water works inside a big city). The characteristic of the long duration gives an uncertainty about the time schedule of the project. Furthermore, the distribution of fresh water to new areas is restricted by geographical limitations, reflected in the company's boundary jurisdiction.

3.3 Project Organization

EYATH S.A. is a company that has a functional form of the project management organization oriented mainly on Operation and Maintenance (O & M) of the existing Thessaloniki's water and wastewater infrastructure. Among others, there are three (3) main divisions below the General Manager - The water supply division (O & M of the water supply system), the sewerage division (O & M of the sewerage system) and the technical works (Design & Construction) division. In order to construct ordinary (small) projects of moderate size and complexity, the detailed plans and specifications are prepared in-house by the design department (under the technical works division). The project is constructed by a

construction contractor and the construction department of the company (again under the technical works division) oversees the project implementation during construction.

The implementation of the strategic plan for water supply management in the wider area of Thessaloniki is not considered as an ordinary project of moderate size and complexity, but rather as a very large, complex, distinctive and complicated project to be undertaken by the company. Moreover, it is important to recognize the need for a continuous change in the nature of the organizational structure as the project is carried out in various stages. The project that we examine needs a different confrontation, that will ensure a better understanding, among all divisions, of all the constraints of the project.

The process for staffing the project can be divided into three parts:

1. find the required people resources,
2. figure out where these people will come from and
3. decide about which is the best type of organizational structure for the project.

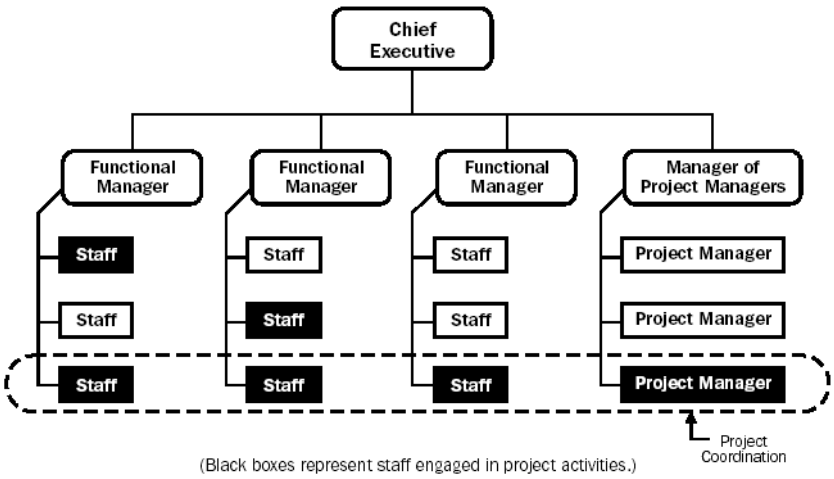
Table 5 shows a list of human resources required to complete the project, their role in the project and the key competencies needed. It also shows time dedication to the project for each person. The total number of people resourced needed to complete the project are 35, most of them skilled engineers with past experience in designing and constructing hydraulic works, coming from inside the company. Apart from the above human resources, contractors for designing the detailed final plans and writing specifications as well as for construction are not included in Table 5.

Table 5: Required human resources for the project.

Role	Approx. Quantity (persons)	Key Competencies needed	Dedication to the project
General Director	1	High level supervision	10%
Subtotal:	**1**		
CFO	1	Financial support and allocation	15%
Payment of contructors & advisors	1	cashier	15%
Manage invoices and bills	1	accountant	25%
Subtotal:	**3**		
Program manager	1	Management of technical hydraulic works	Full Time
Project manager	3	Engineers with past experience in studying and constructing hydraulic works.	Full Time
Team for preliminary studies	2	Engineers with past experience in hydraulic studies and designs.	Full Time
Subtotal:	**6**		
Director of water supply operations	1	Engineer with technical knowledge	25%
On site current operational indications	1	Operations employee in the O&M East sector Dept.	15%
On site current operational indications	1	Operations employee in the O&M East sector Dept.	15%
On site current operational indications	1	Operations employee in the System O&M Dept.	20%
Subtotal:	**4**		
Director of design & construction	1	Engineer with technical knowledge	45%
Head of the design department	1	Engineer with past experience in studying hydraulic works.	60%
Team for design and supervision of outsourcing companies	4	Engineers with past experience in studying hydraulic works.	70%
Team for tender procedures	2	One engineer and one administrative with past experience in this subject.	60%
Head of the construction department	1	Engineer with past experience in constructing hydraulic works.	70%
Team for the supervision of the construction contractors	8	Engineers with past experience in constructing hydraulic works.	80%
Subtotal:	**17**		
Technical Advisors	4	High skilled engineers with past experience in design and construction of hydraulic works	Outsourcing
Subtotal:	**4**		
Total:	**35**		

Due to the functional form of the organizational structure of the company and the fact that the new project is complex and very large, a strong matrix structure of the organizational form must be followed. Moreover, due to the fact that the company does not have enough employees to cope with this project alone, the Matrix Based Organizational will allow employees to focus on their specific technical competencies and allow projects to be staffed with specialists from throughout the company. In this way efficient allocation of all resources can be achieved. This matrix organization structure will have an autonomous project office, while the staff will be grouped and located by speciality into functional units headed by a Functional Manager. Although this way each member of staff will have two or more executives, this organizational structure works well in highly uncertain environments and companies with multiple processes. This proposed matrix organizational structure is shown in Figure 3.

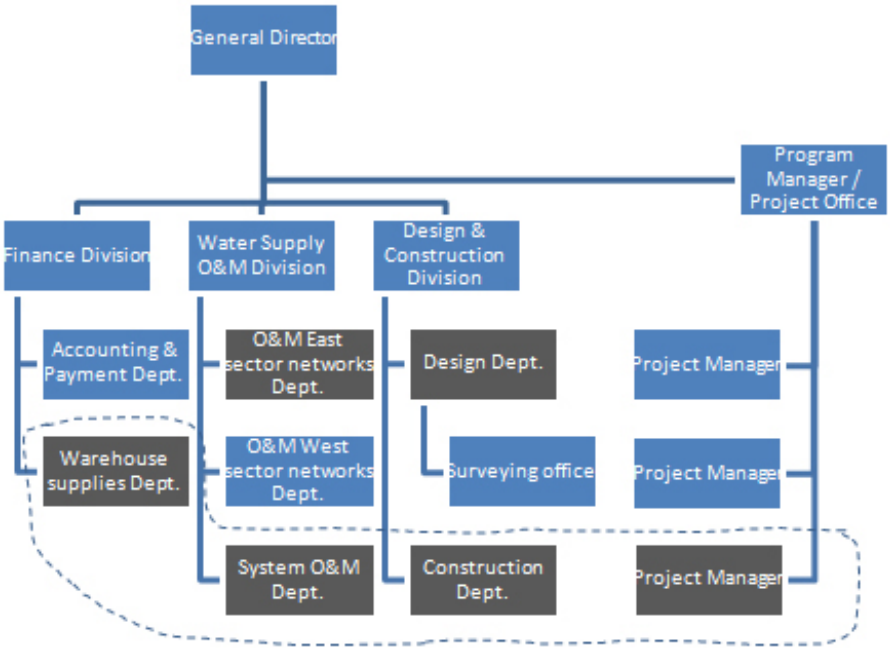
Figure 3: Strong matrix organizational structure*.



* Picture taken from PMBOK (2000)

In our case the functional units represent the departments and Functional Managers the directors of EYATH SA divisions shown in Figure 4 (not all divisions of the company are shown in this figure).

Figure 4: Organizational structure of EYATH SA project.



The Project Office (PO) will operate on a continuum and will be responsible for the results of the project. It will consist of full-time stuff members of the project and a Program Manager having the responsibility for the whole project. The main tasks of the Program Manager and the PO personnel will be the integration of work across the functional lines of the company, in-house and out of house communication, scheduling with risk and uncertainty and have effective control over the entire project. Functional units, together with extra - company contractors will work toward the same specifications, designs and even objectives, with functional team members working in general part time except in cases when, due to strict scheduling endangering risk, full time is needed.

3.4 Scheduling and responsibilities

In order to better manage and understand the complexity of the project, a Work Breakdown Structure (WBS) is created that identifies all the key deliverables and organizes project work to be executed by the project team. The WBS was also used to allocate time and cost estimates to particular sections and to develop the project schedule and budget.

The WBS consists of six (6) basic work groups (work streams):

1. Water supply in the eastern areas.
2. Water distribution in the Metropolitan area of Thessaloniki.
3. Water supply in the western areas.

4. Installation of SCADA systems.
5. Secure the production of new volumes of water. integrity
6. Complementary and supporting actions.

Each group is further decomposed into individual sections, the granularity of which is proportional to the maturity of the designs and specifications of each level. Together with the WBS a project schedule was created using the Gantt chart method. Figures 5 and 6 show the tree shape of the WBS and the project schedule respectively.

In order to construct the project schedule, the following constraints were considered:

- The opening auction (04/2017) and the duration of the refinery construction project is an estimate, as there is now a given date. As the construction of the refinery is not included in the project, the inclusion in the project schedule is only indicative, only for information purposes.
- All the necessary project designs and construction of water projects have been placed in the schedule so that the final system will be ready to receive the new volumes of water coming from the new refinery.
- The required succession between technical studies, tender and execution of projects.
- Some tasks (57, 71, 72, 73) do not have predecessors/successors because of their autonomy, meaning that, although these tasks are needed for the project, they can start and finish during the project at any possible time.

The total time for implementing the project is seven (7) years (2017-2023).

The project roles and responsibilities (who decides what) of the appropriate project stakeholders are assigned using the Responsibility Assignment Consulted Informed (RACI) matrix. The RACI matrix is developed taking into account high-level definitions, describing which unit is responsible for each component of the WBS. However, for simplicity reasons, tasks that present same operations were merged in the RACI matrix. In order to develop the RACI matrix, the following rules were used:

1. For each section of the WBS only one person is set to be Accountable (A sign).
2. Responsible and Accountable signs are mandatory for every section.
3. Consult (C sign) and Inform (I sign) roles are not mandatory for every section.

The RACI matrix can be found in Figure 7.

Figure 5: Work Breakdown Structure (WBS) of the project.

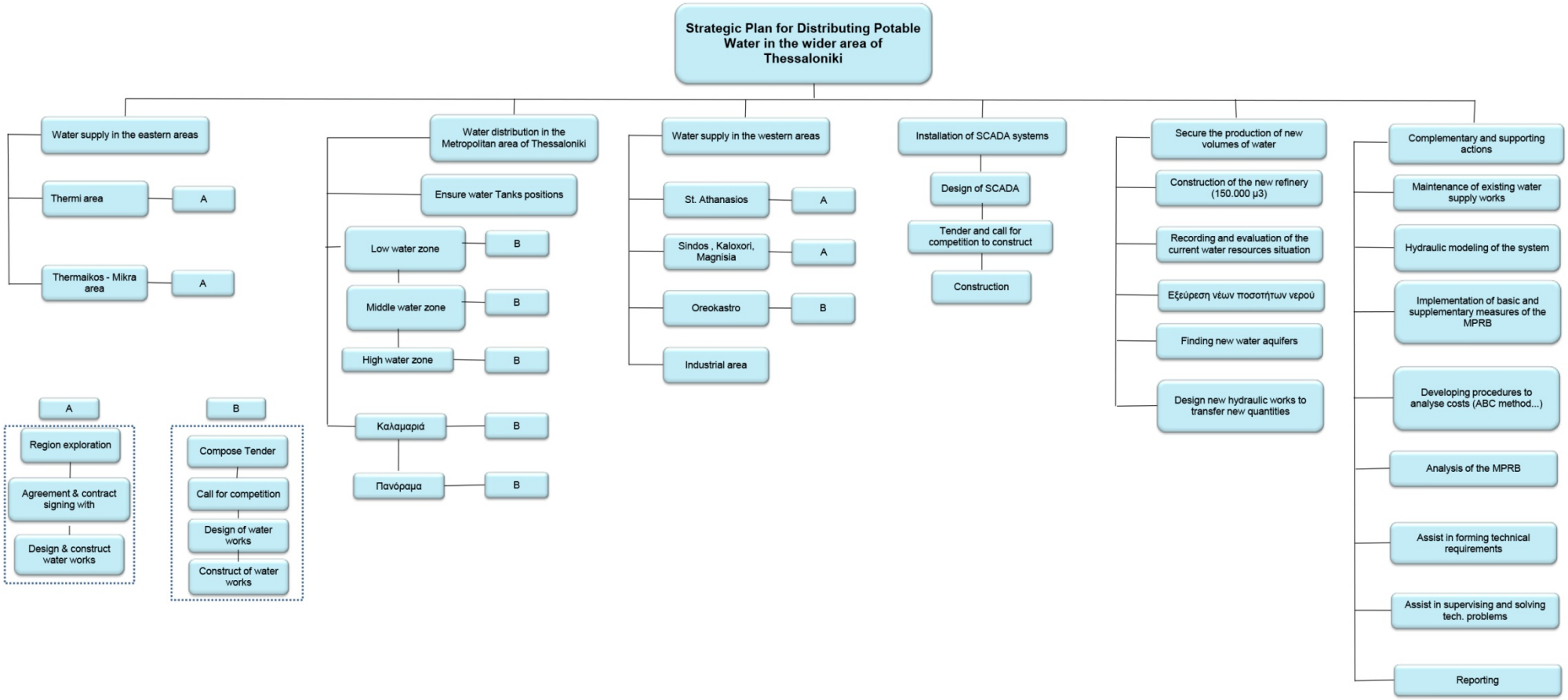
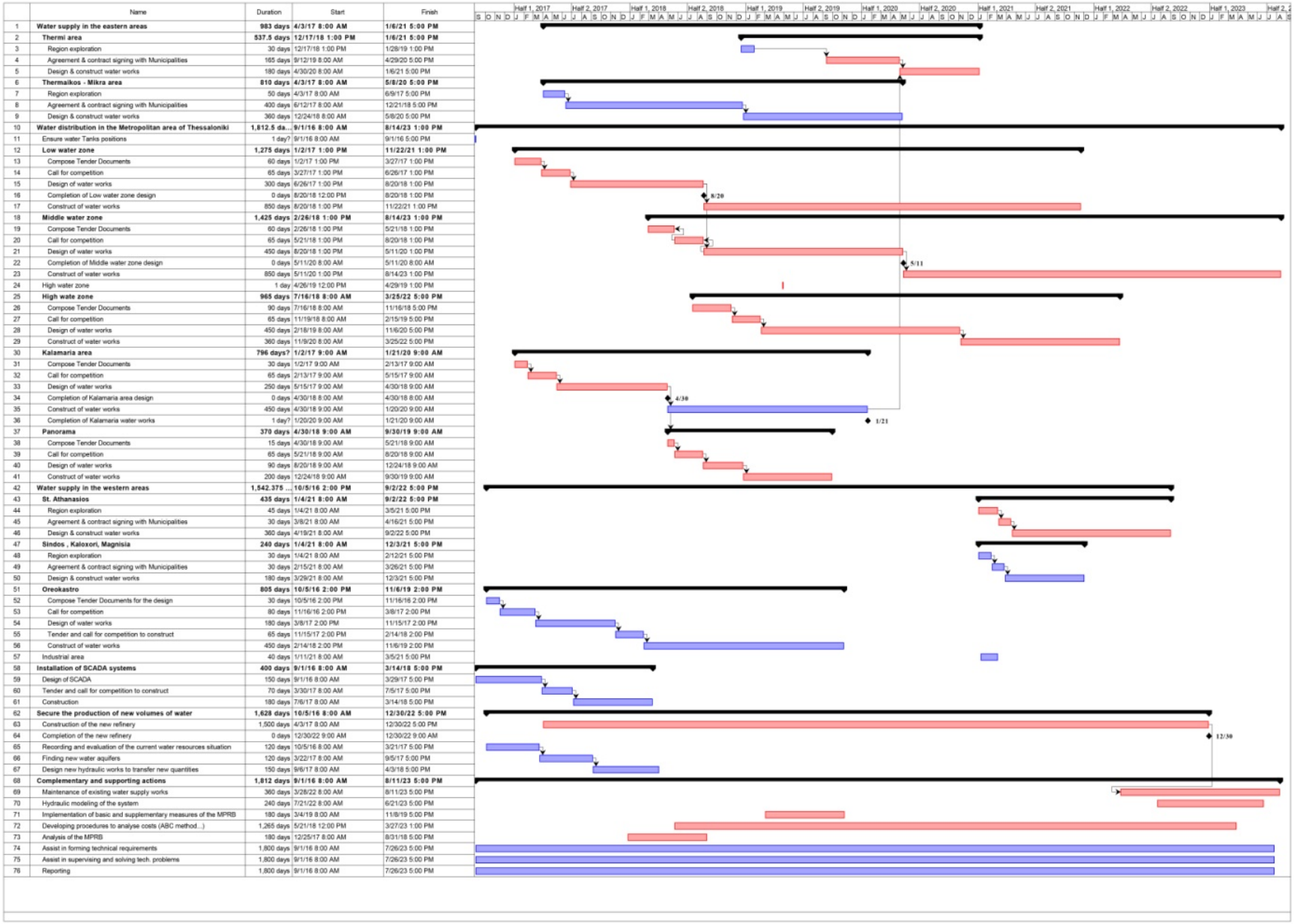


Figure 6: Gantt Chart of the project.



	Name	Duration	Start	Finish
1	**Water supply in the eastern areas**	**983 days**	**4/3/17 8:00 AM**	**1/6/21 5:00 PM**
2	**Thermi area**	**537.5 days**	**12/17/18 1:00 PM**	**1/6/21 5:00 PM**
3	Region exploration	30 days	12/17/18 1:00 PM	1/28/19 1:00 PM
4	Agreement & contract signing with Municipalities	165 days	9/12/19 8:00 AM	4/29/20 5:00 PM
5	Design & construct water works	180 days	4/30/20 8:00 AM	1/6/21 5:00 PM
6	**Thermaikos - Mikra area**	**810 days**	**4/3/17 8:00 AM**	**5/8/20 5:00 PM**
7	Region exploration	50 days	4/3/17 8:00 AM	6/9/17 5:00 PM
8	Agreement & contract signing with Municipalities	400 days	6/12/17 8:00 AM	12/21/18 5:00 PM
9	Design & construct water works	360 days	12/24/18 8:00 AM	5/8/20 5:00 PM
10	**Water distribution in the Metropolitan area of Thessaloniki**	**1,812.5 da...**	**9/1/16 8:00 AM**	**8/14/23 1:00 PM**
11	Ensure water Tanks positions	1 day?	9/1/16 8:00 AM	9/1/16 5:00 PM
12	**Low water zone**	**1,275 days**	**1/2/17 1:00 PM**	**11/22/21 1:00 PM**
13	Compose Tender Documents	60 days	1/2/17 1:00 PM	3/27/17 1:00 PM
14	Call for competition	65 days	3/27/17 1:00 PM	6/26/17 1:00 PM
15	Design of water works	300 days	6/26/17 1:00 PM	8/20/18 1:00 PM
16	Completion of Low water zone design	0 days	8/20/18 12:00 PM	8/20/18 1:00 PM
17	Construct of water works	850 days	8/20/18 1:00 PM	11/22/21 1:00 PM
18	**Middle water zone**	**1,425 days**	**2/26/18 1:00 PM**	**8/14/23 1:00 PM**
19	Compose Tender Documents	60 days	2/26/18 1:00 PM	5/21/18 1:00 PM
20	Call for competition	65 days	5/21/18 1:00 PM	8/20/18 1:00 PM
21	Design of water works	450 days	8/20/18 1:00 PM	5/11/20 1:00 PM
22	Completion of Middle water zone design	0 days	5/11/20 8:00 AM	5/11/20 8:00 AM
23	Construct of water works	850 days	5/11/20 1:00 PM	8/14/23 1:00 PM
24	High water zone	1 day	4/26/19 12:00 PM	4/29/19 1:00 PM
25	**High wate zone**	**965 days**	**7/16/18 8:00 AM**	**3/25/22 5:00 PM**
26	Compose Tender Documents	90 days	7/16/18 8:00 AM	11/16/18 5:00 PM
27	Call for competition	65 days	11/19/18 8:00 AM	2/15/19 5:00 PM
28	Design of water works	450 days	2/18/19 8:00 AM	11/6/20 5:00 PM
29	Construct of water works	360 days	11/9/20 8:00 AM	3/25/22 5:00 PM
30	**Kalamaria area**	**796 days?**	**1/2/17 9:00 AM**	**1/21/20 9:00 AM**
31	Compose Tender Documents	30 days	1/2/17 9:00 AM	2/13/17 9:00 AM
32	Call for competition	65 days	2/13/17 9:00 AM	5/15/17 9:00 AM
33	Design of water works	250 days	5/15/17 9:00 AM	4/30/18 9:00 AM
34	Completion of Kalamaria area design	0 days	4/30/18 8:00 AM	4/30/18 8:00 AM
35	Construct of water works	450 days	4/30/18 9:00 AM	1/20/20 9:00 AM
36	Completion of Kalamaria water works	1 day?	1/20/20 9:00 AM	1/21/20 9:00 AM
37	**Panorama**	**370 days**	**4/30/18 9:00 AM**	**9/30/19 9:00 AM**
38	Compose Tender Documents	15 days	4/30/18 9:00 AM	5/21/18 9:00 AM
39	Call for competition	65 days	5/21/18 9:00 AM	8/20/18 9:00 AM
40	Design of water works	90 days	8/20/18 9:00 AM	12/24/18 9:00 AM
41	Construct of water works	200 days	12/24/18 9:00 AM	9/30/19 9:00 AM
42	**Water supply in the western areas**	**1,542.375 ...**	**10/5/16 2:00 PM**	**9/2/22 5:00 PM**
43	**St. Athanasios**	**435 days**	**1/4/21 8:00 AM**	**9/2/22 5:00 PM**
44	Region exploration	45 days	1/4/21 8:00 AM	3/5/21 5:00 PM
45	Agreement & contract signing with Municipalities	30 days	3/8/21 8:00 AM	4/16/21 5:00 PM
46	Design & construct water works	360 days	4/19/21 8:00 AM	9/2/22 5:00 PM
47	**Sindos , Kaloxori, Magnisia**	**240 days**	**1/4/21 8:00 AM**	**12/3/21 5:00 PM**
48	Region exploration	30 days	1/4/21 8:00 AM	2/12/21 5:00 PM
49	Agreement & contract signing with Municipalities	30 days	2/15/21 8:00 AM	3/26/21 5:00 PM
50	Design & construct water works	180 days	3/29/21 8:00 AM	12/3/21 5:00 PM
51	**Oreokastro**	**805 days**	**10/5/16 2:00 PM**	**11/6/19 2:00 PM**
52	Compose Tender Documents for the design	30 days	10/5/16 2:00 PM	11/16/16 2:00 PM
53	Call for competition	80 days	11/16/16 2:00 PM	3/8/17 2:00 PM
54	Design of water works	180 days	3/8/17 2:00 PM	11/15/17 2:00 PM
55	Tender and call for competition to construct	65 days	11/15/17 2:00 PM	2/14/18 2:00 PM
56	Construct of water works	450 days	2/14/18 2:00 PM	11/6/19 2:00 PM
57	Industrial area	40 days	1/11/21 8:00 AM	3/5/21 5:00 PM
58	**Installation of SCADA systems**	**400 days**	**9/1/16 8:00 AM**	**3/14/18 5:00 PM**
59	Design of SCADA	150 days	9/1/16 8:00 AM	3/29/17 5:00 PM
60	Tender and call for competition to construct	70 days	3/30/17 8:00 AM	7/5/17 5:00 PM
61	Construction	180 days	7/6/17 8:00 AM	3/14/18 5:00 PM
62	**Secure the production of new volumes of water**	**1,628 days**	**10/5/16 8:00 AM**	**12/30/22 5:00 PM**
63	Construction of the new refinery	1,500 days	4/3/17 8:00 AM	12/30/22 5:00 PM
64	Completion of the new refinery	0 days	12/30/22 9:00 AM	12/30/22 9:00 AM
65	Recording and evaluation of the current water resources situation	120 days	10/5/16 8:00 AM	3/21/17 5:00 PM
66	Finding new water aquifers	120 days	3/22/17 8:00 AM	9/5/17 5:00 PM
67	Design new hydraulic works to transfer new quantities	150 days	9/6/17 8:00 AM	4/3/18 5:00 PM
68	**Complementary and supporting actions**	**1,812 days**	**9/1/16 8:00 AM**	**8/11/23 5:00 PM**
69	Maintenance of existing water supply works	360 days	3/28/22 8:00 AM	8/11/23 5:00 PM
70	Hydraulic modeling of the system	240 days	7/21/22 8:00 AM	6/21/23 5:00 PM
71	Implementation of basic and supplementary measures of the MPRB	180 days	3/4/19 8:00 AM	11/8/19 5:00 PM
72	Developing procedures to analyse costs (ABC method...)	1,265 days	5/21/18 12:00 PM	3/27/23 1:00 PM
73	Analysis of the MPRB	180 days	12/25/17 8:00 AM	8/31/18 5:00 PM
74	Assist in forming technical requirements	1,800 days	9/1/16 8:00 AM	7/26/23 5:00 PM
75	Assist in supervising and solving tech. problems	1,800 days	9/1/16 8:00 AM	7/26/23 5:00 PM
76	Reporting	1,800 days	9/1/16 8:00 AM	7/26/23 5:00 PM

Figure 7: Project Responsibility Assignment Consulted Informed (RACI) matrix.

Activity	CEO & President of the company (one person)	General Director	CFO	Program manager	Project manager	Director of water supply	Director of Technical Works	Head of the design department	Team for the design and supervision of outsourcing companies	Head of the construction department	Team for the supervision of the construction contractors	Team for preliminary studies	Team for tender procedures	Technical Advisor
Water supply in the eastern areas (Thermi - Thermaikos - Mikra area)				A	R									
Region exploration								A				R		
Agreement & contract signing with Municipalities	I	I	I				C	A					R	
Design water works							A	A	R	C				C
Construct water works								C		A	R			
Water distribution in the Metropolitan area of Thessaloniki				A	R									
Ensure water Tanks positions						I		A				R		
Low - Middle - High water zones														
Compose Tender Documents								A					R	
Call for competition							I	A					R	
Design of water works						I, C	I	A	R	C				C
Construct of water works	I	I	I			I, C		C		A	R			C
Kalamaria area & Panorama area				A	R									
Compose Tender Documents								A					R	
Call for competition							I	A					R	
Design of water works						I, C	I	A	R	C				C
Construct of water works	I	I	I			I, C		C		A	R			C
Water supply in the western areas (St. Athanasios, Sindos, Kaloxori, Magnisia)				A	R									
St. Athanasios														
Region exploration								A				R		
Agreement & contract signing with Municipalities	I	I	I				C	A					R	
Design of water works						I, C	I	A	R	C				C
Construct of water works	I	I	I			I, C		C		A	R			C
Oreokastro				A	R									
Compose Tender Documents for the design								A					R	
Call for competition							I	A					R	
Design of water works						I, C	I	A	R	C				C
Tender and call for competition to construct	I	I	I							A			R	
Construct of water works	I	I	I			I, C	I	C		A	R			
Industrial area						I, C	I	A				R	R	C
Installation of SCADA systems				A	R									
Design of SCADA							I	A	R					C
Tender and call for competition to construct	I	I	I				I	C		A	R			C
Construction	I	I	I							A	R			
Secure the production of new volumes of water				A	R									
Construction of the new refinery (ONLY FOR INFORMATION PURPOSES)	I	I	I											
Recording and evaluation of the current water resources situation						C	I	A				R		
Finding new water aquifers						I	I	A	R					C
Design new hydraulic works to transfer new quantities		I					I	A	R	C				C
Complementary and supporting actions				A	R									
Maintenance of existing water supply works						A			R					
Hydraulic modeling of the system						C		A	R					C
Implementation of basic and supplementary measures			I				C	A	R					C
Developing procedures to analyse costs (ABC method...)	I		A				I	C		C				R
Analysis of the MPRB		I						A						R
Assist in forming technical requirements		I						A						R
Assist in supervising and solving tech. problems		I					I	A						R
Reporting		I					I	A						R

3.5 Economics

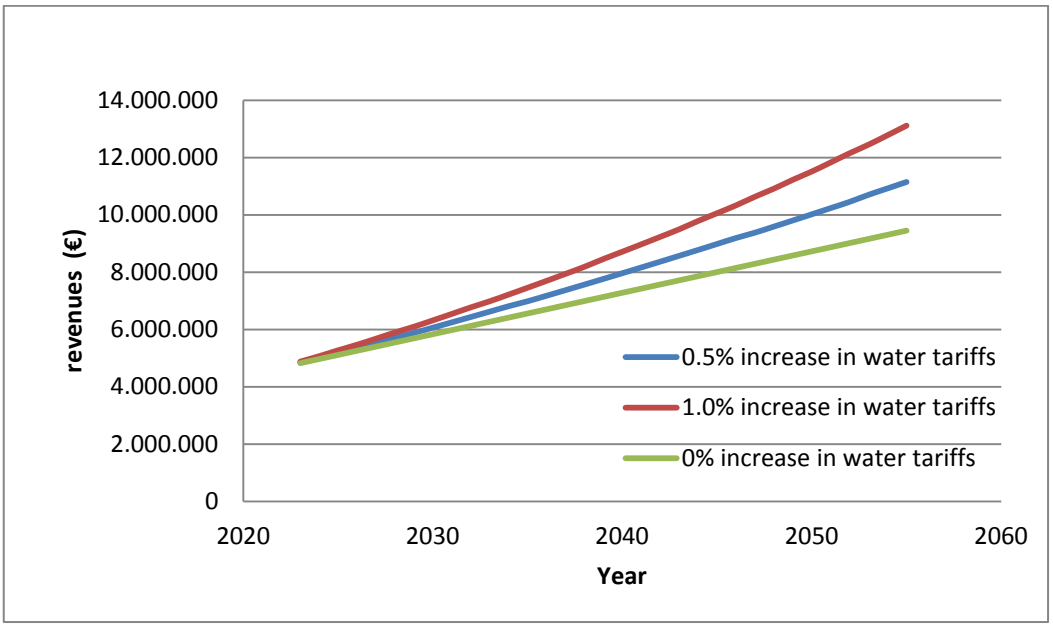
The duration of the project is seven (7) years starting from January 2017 and the project budget is estimated to be 68 mil euro (without including VAT-24%). This budget does not include the cost for constructing the new refinery (27,0 mil € without including VAT-24%).

After constructing all the new water supply works, 126.000 new customers can be served by the company in year 2023 and, according to the population projections, 305.000 new customers in the year 2055. This represents an increase of the water demand by 9.198.000m^3 for the year 2023 (excluding losses estimated at 25% net) and 22.265.000m^3 for the year 2055. Taking into consideration that unaccounted for water in the new settlements reach 50% today and the estimation that in the future it will be reduced to 25%, the above amounts are translated in water production requirements of 13.797.000m^3 for the year 2023 and 27.831.250m^3 for the year 2055. Today, according to EYATh's billing policy, the enhancement of residential areas is charged at 0,35€/m^3. Therefore, it is estimated that the annual revenue from the sale of water to new consumers will be equal to **€**4.828.950 after the completion of construction works (year 2023) and in the future (2055), if water tariffs remain constant, will be equal to **€**9.740.938. If there will be an annual increase in water tariffs by 0,5% or 1,.0%, then the income for the year 2055 will be equal to 27.831.250 * [0,35 * (1 + 0,005) 33] = **€**10.919.591 or **€**12.849.688 respectively. The annual increase of these revenues (annual cash flow) taking into account:

- three scenarios of annual change in water tariffs (0,5% per year, 1% per year and zero increase until 2055),
- 425.280m^3 annual linear increase in water consumption until 2055,
- annual operating and maintenance costs of new projects equal to 2% of annual income for each tariff scenario
- annual incremental cost (incremental or marginal cost) of 1% of annual income for each tariff scenario and
- the year for pricing of new services is 2023,

is shown in the following Figure 8. Calculations can be found in Appendix III.

Figure 8: Annual revenue evolution from the sales of water to new areas for three deferent scenarios.



The Net Present Value (NPV) only for the investment subprojects that will result in the increase of water consumption quantities (water sold to new customers), taking into account:

- the discount rate is equal to 7,95% (yield on Greek ten-year bond) and
- the investment is made according to the data in Table 6,

is shown in Table 7.

Table 6: Investments needed to increase water quantities sold

Investments		
Until 2022*	In the year 2023	In the year 2035
49.854.797 €	**8.000.000 €**	**3.570.000 €**

* The new water refinery investment (29.674.797 €) is also added.

Table 7: NPV of investments that will result in the increase of water quantities sold

Tariff structure	NPV of cash flow* (Annual revenues)	NPV of the investment	Internal Rate of Return (IRR)
0% increase in water tariffs	72.083.986,00 €	13.497.743 €	9,89%
0.5% annual raise in water tariffs	76.715.622,00 €	18.129.379 €	10,44%
1.0% annual raise in water tariffs	81.763.601,00 €	23.177.358 €	10,99%

* discount rate is equal to 7,95%

The above Table 7 shows that, even with zero increase in water tariffs (0,35€/m^3) until 2055, the investment is viable (NPV>0 or IRR>7,95),

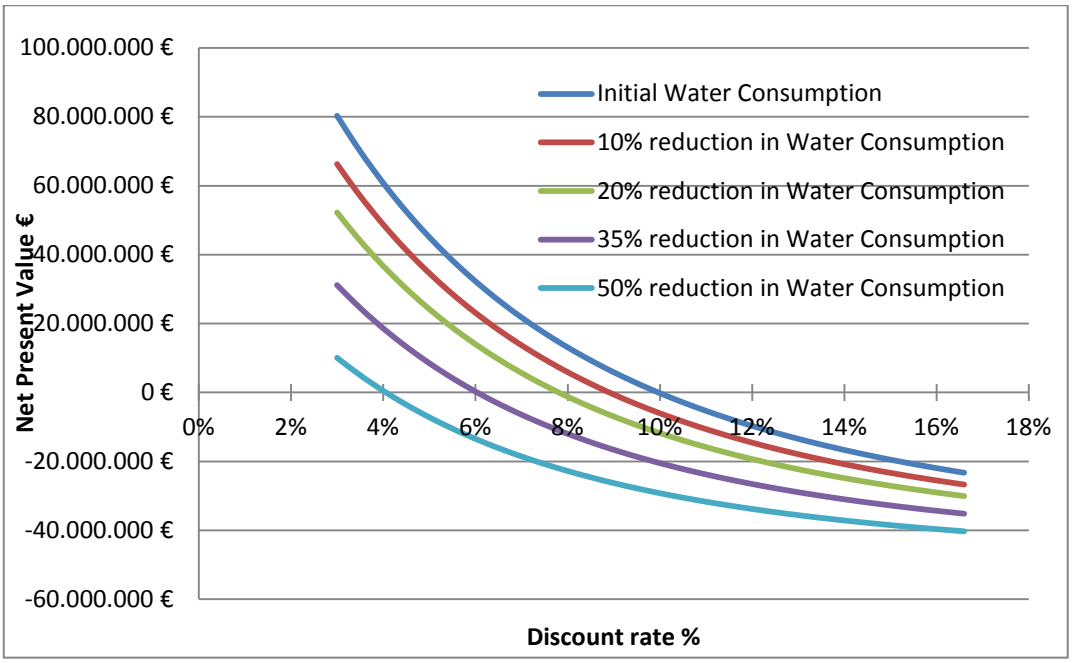
3.5.1 Sensitivity analysis

A basic parameter that influences the above investment scenario is the difficulty in accurately predicting the progress of water consumption quantities throughout the years. Generally, the factors affecting the prediction of future water demand are mainly:

- the errors in estimating future population growth,
- the future specific water consumption assessment,
- the failure in estimating unaccounted for water in the future water distribution system.

Taking all other parameters the same, a sensitivity analysis of the Net Present Value and the Internal Rate of Return was made by changing water consumption quantities throughout the years. The calculations were performed by decreasing the values of water demand - consumption, for the years 2023 and 2055, that were estimated in the first place for the new areas to be served. Moreover, the investments of Table 6 were also taken into account. The results are shown in Figure 9.

Figure 9: Sensitivity analysis on NPV & IRR when water demand changes.



We can conclude from Figure 9 that the NPV of the investment, for a discount rate of 7,95% is taking zero value when water demand is reduced by 18,70%. This means that the investment is feasible even if the initial estimate of the quantities of water, which will be sold after the construction of the new refinery, were to be decreased by 18,7%. Correspondingly, the viability of the investment, in case water demand is reduced by 50%, will be achievable if the discount rate was to be reduced to about 4%.

3.6 Risk Management

On the one hand known unknowns represent identified potential problems that can damage our project, so we can prepare for it. On the other hand unknown unknowns are the problems that arrive un expectedly, the ones that we couldn't see coming. In our complex project we have to expect these problems, because we know that something unexpected always happens. Risk management is all about protecting the project team from problems that catch it off guard, giving the project manager a bullet proof jacket when gunfire is starting.

An important notion about risk management is that it is a repeated process throughout the entire life time of every project. This process consists of five (5) steps:

1. risk management process planning,
2. risk identification,
3. risk analysis and prioritization,
4. respond development and planning and
5. risk monitor and control.

For the purpose of this Business Consultancy Project only the second, third and forth steps will be analyzed.

EYATH SA does not follow any guidelines pertaining to risk management in more general terms or to management of specific risk that should be used and included in the planning risk management process steps. Consequently, a customization of a corresponding implemented risk management approach should be made based on true needs, on the selected project team, project importance and the company's organizational environment. This way, the company will draw the framework and the guidelines to be followed.

The proposed risk identification Table 8 shows the basic possible risks identified for the purpose of this study. These possible risks are referring mainly to general matters that a Project Manager (PM) should consider. The nest step for the PM is to follow a more in-depth investigation by assessing in detail specific information for each subproject before the project starts and after the required people resources are assigned.

The identified risks shown in Table 8 are proposed with a short description, in order to be as understandable as possible and organized into three sections, cause, risk and effect. This list of risks is further analyzed in order to understand their characteristics and focus the attention on the most relevant ones. The analysis link each individual risk with the following qualitative measures:

- the probability of occurrence and
- the impact identification on the project as a whole in terms of timing, cost and quality.

Appendix IV shows the probability scales used for the analysis and the impact scale with its related interpretation. In order to easily and immediately read the gathered data, a report in a matrix-based description formula is made. Figure 10 shows this probability - importance matrix report, where letters correspond to risks and colors to homogeneous risk groups so as to be able to handle them accordingly. As we can conclude from Figure 10 :

1. B & G risks should be further analyzed in quantitative terms and included in the risk response plan.
2. A, E, F & K risks should be further analyzed in qualitative terms and included in the risk response plan.
3. D, C, H, I & J risks should be monitored and further produce a report for them.

In order to reduce the likelihood for each potential risk to break and minimize the overall project risk, measures are proposed in Table 8. These possible risk response measures reflect the following widely accepted available options:

- avoiding risk by not implementing the activity it could have an impact on,
- rationally accepting the risk by understanding that any response can be more negative than actually experience damage,

- transferring risk - assigning risk to external third parties,
- mitigating risk - reducing its probability or its impact, which might mean acting or risks or , even better, acting on causes.
- investigate the risk - temporary strategy for testing the risk.

Figure 10: Project Probability - Importance matrix.

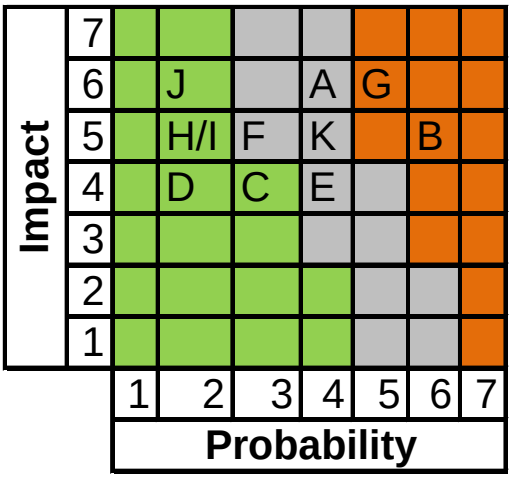


Table 8: Project Identified risks, probability / impact measures & risk response measures.

	Cause	Risks	Effect	Probability	Impact	Strategies
A	Objections / complains and contractor litigations during public procurements.	Delays in the contract formation on public procurement for the provision of services and the execution of water works.	Project time frame might be extended.	4	6	Sometimes candidate contractors try to resort misunderstandings to legal courts. If this is the situation the only think we can do is **accept** it and try to minimize the construction schedule.
B	Problems in expropriation.	Appropriate land requirements for the construction of big water tanks might delay or won't be available.	Subproject decrease in design quality	6	5	**Avoid** the risk by designing the water works after securing land requirements.
C	Problems in getting Public authorizations and approvals during construction (excavation permit etc).	Possible time delay on getting Public approvals.	Failure to follow time schedule.	3	4	**Mitigate** the risk, by reducing probability, at the design phase, investigating about administrative requirements for approval (excavation permits etc) and gather or plan and design all appropriate information to be readily available during the construction phase.
D	Pure employee experience at the design phase.	Plans or specifications of a subproject are inefficient.	If not realized at the design phase - Pure quality and extra cost of the construction works.	2	4	**Transfer** risk by assigning the risk when it occurs to the contractor/constructor in order to solve technical problems during construction.
E	Pure employee experience at the design phase.	Plans or specifications of a subproject are inefficient.	Unexpected time delays and smaller costs might occur if early realized (can go back to the design phase).	4	4	**Avoid** the risk by inserting in the design process an extra inspection / check before handing over plans and specifications.
F	Technical problems.	Unexpected water shortage or disconnections during the construction of water works.	Consumers complaints / decrease in quality of service	3	5	**Mitigate** the risk by informing the customers, about the construction works, through media.
G	Overall delay of the project.	New refinery is build before the construction of the new water works.	New volumes of water will be unexploited / Revenue loss for the company	5	6	**Monitor** the risk and prepare a contingency plan changing the WBS and Gantt chart in order to prefix the appropriate construction works that will convey the additional volumes of water produced.
H	Legal issues/ contractor litigations during public procurement of the refinery construction.	New refinery construction does not start or has many delays resulting in an increase of the project duration.	Big investments in water works will not fully operate / resulted income that is predicted coming from selling water in new areas will be misplaced.	2	5	**Investigate** the possibility of undertaking the construction of the new refinery, in terms of human and financial resources, in order to implement the project
I	Difficulty in agreeing contract terms with Municipalities in new service areas.	Delays in contract formation processes between Municipalities and EYATH SA for serving new areas.	Revenue collection might delay / reduction possibility of annual company's turnover.	2	5	**Share** the risk with the municipality by informing them that the delay will have consequences in the construction schedule and by going to the local press.
J	Selection of a wrong Project	Lack of functional plans integration	Possibility of project failure	2	6	**Avoid** the risk by hiring a PM that knows the business,

	Manager (PM).	into the total project plan.				is skilled to manage uncertainty (risk management) and to integrate all complex functions. Also by developing and training the already engaged PM.
K	The company will hire new inexperienced employees and assign them to the project.	The project manager will face the problem of employees low performance.	Time schedule, cost, quality of the project.	4	5	**Mitigate** the risk by requesting for experienced employees from the top management and by gaining mutual trust with the line managers, especially during staffing sessions.

4 Conclusions - Recommendations

The 21st century will be forced to answer many questions regarding the climate change mitigation and adaptation due to the depletion or contamination of our planet's resources. Depletion and contamination of Water resources are high in the discussion agenda of all developed countries in the world and especially in the EU where the innovate eco-concept of circular economy addresses the growing challenge of reorganizing production, distribution and consumption to maintain / enhance the value of our water resource.

The purpose of this Business Consultancy Project (BCP) is to create a Project Management Plan (PMP) that will help Thessaloniki Water Supply and Sewerage Authority (EYATH S.A.-company) walk through the process of implementing the Operational Plan for Distributing Potable Water in the wider area of Thessaloniki, that was approved by the EYATH's BoD in 2016. This plan includes the constructing of new and the rehabilitation of the existing water works, in order to:

- reduce Non-Revenue Water in the existing water distribution systems
- ensure energy savings during the operational and maintenance procedures
- transfer and distribute new available volumes of potable water (produced after completion of its new water refinery that will ensure an additional 150.000,00m^3 per day) to the wider area of Thessaloniki and

The proposed PMP can ensure that all the procedures, changes, investments, and multi-stakeholder involvement will be addressed, during the life of the project, in an enabling innovative frame.

Having said that, the PMP introduces the importance of a complex list of stakeholders by classifying their interest (importance), power (influence) and Attitude measures in an annotative way, while analyzing their contribution to the project and the techniques for approximating them in a Stakeholders summary participation matrix. It is found that key stakeholders, with very high importance and power, apart from the functional management, the direct management and the team members are EYATH'S customers, its contractors, subcontractors and the designers of hydraulic works, who also play an essential role in planning and execution of the project.

Another component that is emphasized in this PMP is the introduction of a strong matrix structure of the organizational form of the project, compared with the typical functional form the company is implementing in ordinary (small) projects of moderate size and complexity. This matrix organizational structure is a new approach that the company should consider following in order to differentiate the project from other typical procedures and deal with its complexity and complicated technical requirements. This way the project will become more resilient to necessary dynamic changes it will probably experience in the future.

The foundations of a risk management plan are also considered in this PMP by identifying basic risks, analyzing them and setting response actions in order to break and minimize the overall project risk. Two important risks were brought into light, the risk of losing appropriate land requirements for the construction of big water tanks and the risk of finishing the project after the new water refinery is completed. Both risks present significant negative effects. However the first one should be avoided and the second one should be monitored.

The general aim of this Business Consultancy Project was to try and engage the company in using Project Management tools in the implementation of its new big investment plans. This could aid the company to overcome implementation difficulties and problems and build a platform for innovation. Furthermore, due to its structural integrity, this PMP or its autonomous building blocks can be applied in the Greek water industry by the Municipal Water and Sewage Authorities (MWSA).

If any MWSA is interested in applying this PMP to its Operational Plan for Distributing Potable Water, further future technical development and intensive analysis of specific tasks should be realized. This way, a customization of a corresponding implemented project management approach should be made based on true needs, on the selected project team, project importance and the company's organizational environment. This way, the company will draw further framework and guidelines to be followed.

REFERENCES

Adrienne Watt (2016), https://opentextbc.ca/projectmanagement/chapter/chapter-5-project-stakeholders -project-management/.

Baumann D.D., J.J Boland and W.M. Hanemann (1997) "*Urban Water Demand Management and Planning*'', McGraw-Hill.

Bobera D., (2008), "Project Management Organization", Management Information Systems, Vol.3, No. 1

Chris Hendrickson (2008), "Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders", Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, Second Edition (version 2.2) prepared for world wide web, (http://pmbook.ce.cmu.edu/index.html).

DIRECTIVE 2014/25/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

EYATH SA, (2016), "Annual report for fiscal year 2015", Thessaloniki, Greece.

IHU EMBA (2015) Reading notes from the course syllabus "Project Management" titled -Stakeholder management-, SDA Bocconi School of Management

IHU EMBA (2015) Reading notes from the course syllabus "Project Management" titled -Project Risk Management, SDA Bocconi School of Management

IHU EMBA (2015) lecture notes from the course syllabus "Project Management".

Larry W. Smith (2000), "Project Clarity Through Stakeholder Analysis", CrossTalk - The Journal of Defense Software Engineering, Vol. 13, No12 (http://www.crosstalkonline.org/).

Mentes A. and Anastasiadis C., (2016) "Operational Plan for Distributing Potable Water in the wider area of Thessaloniki", EYATH SA.

Mentes A. (2015), "A Cost Volume Profit analysis for the Water Supply and Sewerage Company of Thessaloniki SA (EYATH S.A.)", assignment written for the IHU EMBA2015 course syllabus <Managerial accounting for value creation>.

Nahod M. M., Radujkovic M., (2015), "Project in different organization structures and transition from non-project to the more project oriented organization structure", (https://www.researchgate.net/publication/ 265228773).

Pm4dev, (2007), "Project Management Organizational Structures", Management for development series.

Social Development Department (1995), "GUIDANCE NOTE ON HOW TO DO STAKEHOLDER ANALYSIS", OVERSEAS DEVELOPMENT ADMINISTRATION, (http://www.euforic.org/gb/stake1.htm).

PMBOK (2000), "A Guide to the Project Management Body of Knowledge", Project Management Institute Inc.

Verzuh E., (2016), "The fast forward MBA in Project Management", Wiley pubs, fifth edition.

APPENDIX I

A stakeholder table of the project that also shows the interest (importance) - power (influence) - Attitude measures in an annotative way with a range of numbers (from -10 to 10 and from 0 to 10 for the attitude measure).

			Stakeholder Name	Impact / Interest / Importance	Power / Influence	Attitude
				How much does the project impact them? (From -10 to 10)	*How much influence do they have over the project? (From -10 to 10)*	*How much do they like the project? (From 1 to 10)*
1	Internal	Owners	General Assembly	**3**	**3**	**5**
2			BoD	**4**	**7**	**8**
3		Functional Management	CEO	**8**	**9**	**9**
4			General Director (GD)	**1**	**5**	**2**
5			CFO	**-3**	**2**	**2**
6			Technical Board	**-2**	**2**	**1**
7			Employee Representatives	**2**	**3**	**3**
8		Direct Management	Director of Technical Works	**5**	**3**	**5**
9			Director of Water Supply	**8**	**7**	**7**
10		Functional Dept	Director of Seweragel Works	**-8**	**-7**	**1**
11			Financial Division Employees	**-2**	**-7**	**2**
12		Team Members	Head of Design Division	**9**	**8**	**10**
13			Design Division Employees	**8**	**7**	**8**
14			Head of Construction Division	**9**	**8**	**10**
15			Construction Division Employees	**8**	**8**	**8**
16			Water Supply Employees	**9**	**7**	**7**
17			Team Member Families	**2**	**-8**	**1**
18	Independent		Construction Works Acceptance Committee	**-5**	**3**	**1**
19			Audit	**-8**	**-2**	**2**
			Bank (where the loan comes from)	**-7**	**1**	**2**
20	External	Customers	Customers	**4**	**1**	**3**
21			DEYA*	**5**	**-2**	**4**
22		Community	Social Networks	**-6**	**2**	**1**
23			Municipalities	**5**	**-2**	**2**
24		Government	EYATH ASSETS	**7**	**-5**	**5**
25			Environmental Agency	**-9**	**-2**	**1**
26			Perfecure of Central Macedonia	**-6**	**-2**	**2**
27			Archeology Agency	**-8**	**-3**	**1**
28			Forest Agency	**-9**	**-5**	**1**
29		Ventors	Suppliers	**2**	**-2**	**2**
30			Contractors	**5**	**5**	**6**
31			Subcontractors	**4**	**4**	**6**
32			Designers of Hydraulic Works	**4**	**5**	**8**
33			Designers of Electrical & Mechanical Works	**4**	**-2**	**5**
34			Designers of Geotechnical Works	**3**	**-8**	**1**
35			Designers of Civil Works	**2**	**-8**	**1**
36			Surveyors	**-2**	**-8**	**1**
37		Media	Local newspapers/Radio/Internet/Television	**-8**	**-3**	**2**
	*	Municipal Water and Sewerage Authority		Area A		
				Area B		
				Area C		
				Area D		

APPENDIX II

Analysis of Key - Important Stakeholders role and profile.

1. General Assembly

Stakeholders Role to the Project	Approves funding for the project ones at the beginning.
What is important to the Stakeholder	The annual dividend.
How could the stakeholder contribute to the project	Approve the funding scheme of the project ones at the beginning.
How could the stakeholder block the project	- By closing down the project - Not approving the funding scheme.
Strategy to engaging the Stakeholder	- Inform in great detail about the benefits of the project and added value it will bring to the company. - Find a funding scheme that will balance dividend payments.
Impact / Interest / Importance (from -10 to 10)	3
Power / Influence (from -10 to 10)	3
Attitude (from 1 to 10)	5

2. Board of Directors (BoD)

Stakeholders Role to the Project	- Approves funding for individual project activities . - Approves changes affecting schedule. - Approves changes affecting cost. - Approves final construction designs. - Set the organizational goals that drive the necessity of this project. - Approves big (>20.000€) contracts for contractors & suppliers.
What is important to the Stakeholder	To finish the project on time and start earning money from it.
How could the stakeholder contribute to the project	Help solve problems and difficulties the project team will face. For example communicate with other stakeholders to overcome a problem or to express their support for reforms.
How could the stakeholder block the project	- By closing down the project - By not approving changes affecting schedule and cost .
Strategy to engaging the Stakeholder	- Information and feedback every 2 months by the project manager during BoD meetings
Impact / Interest / Importance (from -10 to 10)	4
Power / Influence (from -10 to 10)	7
Attitude (from 1 to 10)	8

3. Chief Executive Officer (CEO) and President (one person)

Stakeholders Role to the Project	- Recommends to the BoD funding for individual project activities. - Recommends to the BoD changes affecting schedule. - Recommends to the BoD changes affecting cost. - Will assign people to the project team and determine the hours per day they work on the project. - Approves small (<20.000€) contracts for contractors & suppliers.
What is important to the Stakeholder	To finish the project on time and start earning money from it.
How could the stakeholder contribute to the project	Help solve problems and difficulties the project team will face. For example communicate with other stakeholders to overcome a

	problem or to express their support for reforms.
How could the stakeholder block the project	- By setting new and different priorities to be executed by members of the project team. - By postponing important decisions to be made by the BoD.
Strategy to engaging the Stakeholder	- Information and feedback every 1 months by the project manager.
Impact / Interest / Importance (from -10 to 10)	8
Power / Influence (from -10 to 10)	9
Attitude (from 1 to 10)	9

4. General Director (GD)

Stakeholders Role to the Project	- Represents organization policies governing this project. - Drives the necessity of this project.
What is important to the Stakeholder	- Minimize the risks associated with the project. - The quality of the deliverables.
How could the stakeholder contribute to the project	- Solving communication problems between the Project Office and functional units.
How could the stakeholder block the project	- By looking the other way.
Strategy to engaging the Stakeholder	- Develop in-depth plans and major milestones that must be communicated to the GD during the planning and design phases of the project. - Keep the GD informed of project risks and potential impacts at all times.
Impact / Interest / Importance (from -10 to 10)	1
Power / Influence (from -10 to 10)	5
Attitude (from 1 to 10)	2

5. Chief Financial Officer (CFO)

Stakeholders Role to the Project	- Reassure that all payments and liabilities concerning the project will be met on time.
What is important to the Stakeholder	- All the appropriate payment documents comply with payment requirements.
How could the stakeholder contribute to the project	- Minimize payment timeschedule
How could the stakeholder block the project	- Delay payments.
Strategy to engaging the Stakeholder	- Develop a status reporting on project payment requirements and inform CFO on regular basis (each month).
Impact / Interest / Importance (from -10 to 10)	-3
Power / Influence (from -10 to 10)	2
Attitude (from 1 to 10)	2

6. Technical Board (TB)

Stakeholders Role to the Project	- Expresses opinion when asked by the BoD mainly for technical matters.
What is important to the Stakeholder	- To express opinion that comply with legal commitments. - To understand the questions asked by the BoD.

How could the stakeholder contribute to the project	- Influences the BoD and the CEO. - Usually helps solving technical problems
How could the stakeholder block the project	- If they are asked to consent with something against the law .
Strategy to engaging the Stakeholder	- making detailed inquiries to the BoD, that always comply with legal commitments.
Impact / Interest / Importance (from -10 to 10)	-2
Power / Influence (from -10 to 10)	2
Attitude (from 1 to 10)	1

7. Employee Representatives (ER)

Stakeholders Role to the Project	- Have voting rights in the BoD that can influence the decisions concerning the project
What is important to the Stakeholder	- To maintain working conditions for all the employees
How could the stakeholder contribute to the project	- Agreeing for union members to implement the project - Usually helps solving technical problems
How could the stakeholder block the project	- By voting against in the BoD. - By putting day to day obstacles to the project. - By going on strike.
Strategy to engaging the Stakeholder	- Monthly round table discussions for information sharing
Impact / Interest / Importance (from -10 to 10)	2
Power / Influence (from -10 to 10)	3
Attitude (from 1 to 10)	3

8. Director of Technical Works (DTW)

Stakeholders Role to the Project	- He is a Functional Manager - Decides about technical requirements. - Approve the statement of work and the project plan.
What is important to the Stakeholder	- All day to day work is done
How could the stakeholder contribute to the project	- Make sure every project member from his division is working for the project and alongside doing his day to day work.
How could the stakeholder block the project	- By blocking his staff from working part time for the project. - By resigning in the middle of the project. - By not understanding the project goals.
Strategy to engaging the Stakeholder	- Reminding in a well-mannered way the statement of work every 2 months. - Ask for information and feedback every two months.
Impact / Interest / Importance (from -10 to 10)	5
Power / Influence (from -10 to 10)	3
Attitude (from 1 to 10)	5

9. Director of Water Supply (DWS)

Stakeholders Role to the Project	- Will have to cope with change of the system he operates or processes because of this project - Gives his opinion about technical requirements. - Approve the statement of work and the project plan.
What is important to the Stakeholder	- Every day System Operation & Maintenance work is done
How could the stakeholder contribute to	- Make sure every project member from his division is working for

the project	the project and alongside doing his day to day work.
How could the stakeholder block the project	- By blocking his staff from working part time for the project. - By resigning in the middle of the project. - By not understanding the project goals.
Strategy to engaging the Stakeholder	- Reminding in a well-mannered way the statement of work every 2 months. - Ask for information and feedback every two months.
Impact / Interest / Importance (from -10 to 10)	8
Power / Influence (from -10 to 10)	7
Attitude (from 1 to 10)	7

APPENDIX III

Revenue evolution calculations from the sales of water to new water supply areas.

		0% increase in water tariffs	0.5% annual raise in water tariffs		1.0% annual raise in water tariffs	
Year	m^3/year	Annual revenues	water tariffs (€)	Annual revenues	water tariffs (€)	Annual revenues
	(1)	(2)	(3)	(1*3-0.03*1*3)	(4)	(1*4-0.03*1*4)
2023	14.222.280	4.828.464 €	0,352	4.856.055 €	0,354	4.883.647 €
2024	14.647.561	4.972.847 €	0,354	5.029.679 €	0,357	5.072.304 €
2025	15.072.841	5.117.229 €	0,355	5.190.333 €	0,361	5.278.057 €
2026	15.498.121	5.261.612 €	0,357	5.366.844 €	0,364	5.472.077 €
2027	15.923.402	5.405.995 €	0,359	5.545.006 €	0,368	5.684.017 €
2028	16.348.682	5.550.377 €	0,361	5.724.818 €	0,372	5.899.258 €
2029	16.773.962	5.694.760 €	0,362	5.890.009 €	0,375	6.101.529 €
2030	17.199.242	5.839.143 €	0,364	6.072.709 €	0,379	6.322.957 €
2031	17.624.523	5.983.525 €	0,366	6.257.058 €	0,383	6.547.686 €
2032	18.049.803	6.127.908 €	0,368	6.443.058 €	0,387	6.775.716 €
2033	18.475.083	6.272.291 €	0,37	6.630.707 €	0,39	6.989.124 €
2034	18.900.364	6.416.673 €	0,372	6.820.007 €	0,394	7.223.341 €
2035	19.325.644	6.561.056 €	0,373	6.992.211 €	0,398	7.460.858 €
2036	19.750.924	6.705.439 €	0,375	7.184.399 €	0,402	7.701.675 €
2037	20.176.205	6.849.821 €	0,377	7.378.236 €	0,406	7.945.793 €
2038	20.601.485	6.994.204 €	0,379	7.573.724 €	0,41	8.193.211 €
2039	21.026.765	7.138.587 €	0,381	7.770.862 €	0,415	8.464.324 €
2040	21.452.045	7.282.969 €	0,383	7.969.649 €	0,419	8.718.755 €
2041	21.877.326	7.427.352 €	0,385	8.170.087 €	0,423	8.976.486 €
2042	22.302.606	7.571.735 €	0,387	8.372.175 €	0,427	9.237.516 €
2043	22.727.886	7.716.117 €	0,389	8.575.913 €	0,431	9.501.847 €
2044	23.153.167	7.860.500 €	0,391	8.781.302 €	0,436	9.791.937 €
2045	23.578.447	8.004.883 €	0,393	8.988.340 €	0,44	10.063.281 €
2046	24.003.727	8.149.265 €	0,395	9.197.028 €	0,444	10.337.925 €
2047	24.429.008	8.293.648 €	0,396	9.383.670 €	0,449	10.639.566 €
2048	24.854.288	8.438.031 €	0,398	9.595.246 €	0,453	10.921.223 €
2049	25.279.568	8.582.413 €	0,4	9.808.472 €	0,458	11.230.701 €
2050	25.704.848	8.726.796 €	0,402	10.023.349 €	0,462	11.519.371 €
2051	26.130.129	8.871.179 €	0,404	10.239.875 €	0,467	11.836.687 €
2052	26.555.409	9.015.561 €	0,406	10.458.051 €	0,472	12.158.128 €
2053	26.980.689	9.159.944 €	0,409	10.704.049 €	0,476	12.457.524 €
2054	27.405.970	9.304.327 €	0,411	10.925.938 €	0,481	12.786.803 €
2055	27.831.250	9.448.709 €	0,413	11.149.477 €	0,486	13.120.208 €
	Total:	**235.573.363 €**		**259.068.338 €**		**285.313.532 €**

APPENDIX IV

Probability scales used for the analysis.

1		2		3		4		5		6		7	
Very Low		Low		Medium/ low		Medium		Mediunm/ High		High		Extremely High	
10%	22%	22%	34%	34%	46%	48%	58%	58%	70%	70%	82%	82%	94%

Impact scales with its related interpretation.

Impact	Interpretation
7	The project cannot be viewed as successful.
6	Up to 30% increase in costs, or in timing, or quality to be viewed as "borderline" in terms of acceptability.
5	A 20% to 29% increase in costs, or in timing, or quite poor quality.
4	A 10% to 19% increase in costs, or in timing, or remarkable decrease in quality.
3	An increase from 3% to 10% in costs, or in timing, or visible decrease in quality.
2	Up to 2% increase in costs, or in timing, or a slightly measurable decrease in quality.
1	Impact almost unobserved.